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# MODERN METHODS OF BUILDING

By PROFESSOR S. D. ADSHEAD, M.A., M.Arch., F.R.I.B.A.

AND

# THE CONSTRUCTION OF THE MODERN HOUSE

By HERBERT A. WELCH, F.R.I.B.A.

BEING

## TWO CHADWICK LECTURES

UNDER

“THE BOSSOM LECTURES AND SCHOLARSHIP GIFT”

*given in the “Henry Farvis Room”  
of the Royal Institute of British Architects,  
December 1 and 17, 1936*



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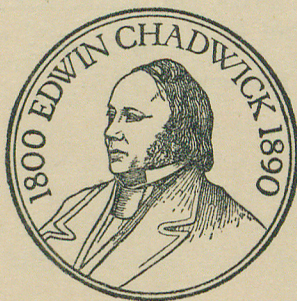
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1937



# THE CHADWICK TRUST

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## FOREWORD

IN these days of rapid change no field of activity has been so disturbed as that which is represented by the building industry. Architects and builders have neither the time nor the opportunity to make a personal examination of all that is happening.

They may rely upon the opinion of those who have experimented. They may visit the Building Centre in Bond Street. They may visit the Building Exhibitions that are held at Olympia and at the Horticultural Hall, and they may study the reports of the Building Research Station; but even then, if they have had no personal experience of the use of a new material, or a new method of building that has recently been introduced, they must depend upon their own personal experience and innate judgment.

The tendency is for architects and builders to follow a safe course; use only well-tried methods and old materials, avoid experiments, and make sure that nothing will go wrong. But, these are not the methods of a people, or of a country, that must perforce keep abreast of the times. This is not the way to success in a competitive age.

We are therefore indebted to the Trustees of the Chadwick Trust and to Mr. Alfred Bossom, M.P., for providing these lectures.

The first of a Course of Six Lectures was delivered by Professor S. D. Adshead at the rooms of the Royal Institute of British Architects at 66, Portland Place, under the Chairmanship of Mr. Alfred Bossom, when the subject was reviewed from its widest standpoint.

It was shown that not only had the introduction of modern methods and materials revolutionized building, but also had brought to a conclusion a long sequence of tradi-



tional styles of architecture, and had exerted a greater influence than any other factor in the development of a modern style.

Mr. Herbert Welch, who followed at the R.I.B.A., gave a lecture for which Sir William Collins, Chairman of the Chadwick Trustees, presided, on "The Construction of the Modern House," and in so doing fully dealt with one of the most popular of modern building problems.

These two lectures are to be followed by others, viz.—

3. MR. RANDAL PHILLIPS, Hon.A.R.I.B.A.—  
"The Modern House and its Equipment."
4. MR. A. H. BARKER, B.A., B.Sc., M.Inst.C.E.—  
"The Relative Advantages of Heating by Coke, Gas, and Electricity."
5. MR. R. FITZMAURICE, B.Sc., A.M.Inst.C.E. (of the Building Research Station)—  
"On Choosing Materials and Methods of Construction for Modern Buildings."
6. MR. BURNARD GEEN, M.Inst.C.E.—  
"The Modern Treatment of Foundations on Difficult Sites."

It should be explained that of Charitable Trusts few have a wider significance than that which has made itself responsible for the delivery of these lectures.

The Chadwick Trust, of which Mrs. Aubrey Richardson, O.B.E., is now clerk and lecture secretary, was fortunate in having by the generosity of Mr. Alfred Bossom, M.P., presented to it in the year 1925, a donation which enabled it to promote lectures dealing with improved methods and materials employed in building, and known as the Bossom Gift Lectures and Scholarship; also, every five years to award, at their discretion, a Scholarship for research in a kindred subject.

S. D. A.



## MODERN METHODS OF BUILDING

By PROFESSOR S. D. ADSHEAD, M.A., M.ARCH., F.R.I.B.A.

It is about fifty years since I entered the profession of architecture, and in that half-century materials and methods of building construction have completely changed. I have had to learn my building construction twice over, and I am not sure that I have quite mastered the second course.

Fifty years ago we built in brick and stone. Steel to replace cast iron for girders is a recent innovation. Cement as a matrix in concrete was scarcely known: concrete in foundations was an exceptional and extravagant security: soil pipes were jointed in clay; and a damp course was an exception rather than a rule. For roof coverings we had slates and tiles, asphalt for flat roofs was not a practical proposition: flats and gutters were covered with 7-pound lead.

We knew all about wooden floor joists, sash windows, and panelled doors. Baths and W.C.'s were cased in and had mahogany copings: sinks were lead lined, and lavatory basins were circular, set in marble surrounds.

Terra cotta as a building material to replace stone was fostered if not introduced by Alfred Waterhouse and first used in the Natural History Museum. Ruskin and William Morris preached the doctrine of simple truth. Timber must be solid: there must be no graining, no marbling, and the use of cast iron as an expedient to avoid the expense and labour necessary to manipulate wrought iron must be debarred. As good practitioners we upheld these truths, but we had no compunction in using sham half-timber in our gables, fitch beams and hollow walls.

By-laws controlling building construction were framed to conform to the requirements of the 1875 Public Health



Act, and though building construction has since then completely changed, there has not been a corresponding amendment of by-laws; and building construction being in practice very subservient to the requirements of building by-laws, innovations and departures from well-recognized methods have been very difficult to introduce.

I suppose that the great changes which have taken place in the use of materials and methods of construction have been brought about by discoveries in chemistry and metallurgy; to a demand for higher standards of living and working; and to improvements in the design and use of tools.

Since the War new methods of building construction have come forward with such rapidity, and the introduction of new materials in such a surprising variety, that a national adherence to traditional architecture, depending upon the use of traditional materials and methods has weakened; the purity of traditional architecture has degenerated, and our old friends—the Orders—have had to go.

And so we get modern architecture, which in its most advanced form is little more than æsthetically designed engineering, and in its intermediary phases, traditional architecture constructed in a new way.

When a history of the architecture of the present century comes to be written, it will be seen that the architects of the present century have been engaged in a continuous struggle in endeavouring to retain the solid architectural effects of the eighteenth and early nineteenth centuries, and at the same time introduce the new materials that have made it only too easy to alter the scale and proportion which were so characteristic of that period. Stone lintels could then never exceed 6 or 8 feet in length, but with steel and concrete they can be made to stretch across almost any conceivable span. Thus, traditional architecture has still been perpetuated even when the new methods and materials have resulted in exaggerating its forms out of all comparison with their original shape and size.

Some assert that sound building construction is bound to produce good architecture, they make architecture depend



upon construction, and good construction upon compliance with the functions which the building has to perform. Personally I think it all depends upon the functions ; when noble and elevating this may be so, but when mean and niggardly, there can be no architectural expression. I like to think of my architecture as being something that glories in building construction, and something that gives expression to functional needs only in so far as function transcends, creature comforts, sanitation and the ordinary routine of living from day to day : something that converts a glass-house into a crystal palace.

Building construction in the past has always been subservient to architecture : architecture has a spiritual value and a value which transcends compliance with ordinary functional purpose and all the petty requirements of good building. To-day to give expression to petty functional requirements is frequently regarded as being the same as producing architecture. Sometimes, as in the case of a memorial, the useful purpose is practically negligible : but, on the other hand, in the case of, say, a power station, or a factory, its merits as a piece of architecture will depend entirely upon the way in which it gives expression to great human motives. Architectural qualities may be found in its massing, or in its colouring, and then only if as an utilitarian object there is something noble in its use and purpose—so that architecture leads construction when produced in its true form. It does not economize construction, it ennobles it, and there is not much difference between modern architecture, as seen in some of the most advanced examples, and æsthetic engineering, the new type of engineering ; and so used it is more abstract than architecture as we understand it in its traditional sense, and as we have known it and recognized it in the past.

I understand that the Swedish architects—and Swedish architecture is perhaps as advanced as any type of modern architecture in Europe—consider that all such perfectly plain buildings as blocks of tenements and factories, however finely proportioned, are in their best expression examples of æsthetic engineering, and that architecture has an



ancestry and re-incarnates traditional forms as well as satisfying material needs.

I must remember that I am an architect, addressing, amongst many others, a body of architects in a building which stands for the progress of that profession. I am not a builder, I am an architect, and for that reason I wish it to be clearly understood that in reading the introductory lecture to a course which is to touch upon every aspect of the problem of using new methods and new materials, I do so, fully aware of my responsibilities, which are these—that the new materials which improvements in science have placed in our hands must not be used so exclusively, and if I might venture to say so, so economically, in meeting functional requirements as to deprive our buildings of all that elevating something which we rightly term “Architecture.”

I do not think that our problem is one of reproducing old traditional skins and stuffing them with cement and wires. I do feel that the possibilities of our new materials, which permit of higher buildings, greater spans and thinner walls, should give us new results, not only as regards the construction of the matrix, but also as regards the skin. I do believe that if you wish to reproduce the effect of a Norman Church, Feudal Castle, or a Tudor Mansion you must use the materials of which they were originally built ; and that is what Ruskin and Morris meant when they spoke and wrote of truth in building : but do we want to be always resuscitating and reproducing Norman Churches, Feudal Castles, and Tudor Mansions ? Probably on occasion we do, and provided we do so as a perfectly conscious effort and as a gesture, a rather dramatic amusement, I see no harm in reproducing “Period” architecture : but this is not really our concern. Whilst I, for one, am not such a futurist as to wish to throw over all connections with the past and destroy all the relics and remains of my ancestors, at the same time I do not think it is quite healthy to continue to produce nothing but pure traditional forms. I feel we best satisfy our problem by throwing over, as it were, the architecture of the past, and directing our attention to what



I have already referred to as "æsthetic engineering," but æsthetic engineering which takes cognizance of those attributes of architecture, which are embodied in such terms as humanism, character, and symbolism. But to descend from these realms of ætherial speculation, these interesting philosophic thoughts which bear upon the meaning of architecture, to real and practical problems, it seems to me that I might dogmatize as follows:

1. Apart from architecture which is consciously traditional, dramatic, incidental, amusing, superficial and trivial, modern architecture must embody, and make use of in its expression, all those new materials and methods of construction with which we are to-day so richly endowed.

2. As well as satisfying purely utilitarian needs it must by the disposition of its form, its colour, and attached symbols, reflect tradition.

In modern architecture there are very many differing phases of expression depending upon the differing outlooks of different nations, and the extent to which these approximate to, or depart from, pure engineering.

And now I come to actual methods of construction. I think I might say that ferro-concrete is proving to be a more acceptable method of building construction than its predecessor—brick or stone encasing a steel frame.

Personally I am not quite satisfied that the present form of reinforced concrete building cannot be improved upon. It does seem to me to be a more advanced method of construction to have a few real bones, a skeleton of steel to strengthen the mass of wire and concrete. I do not mean a skeleton of steel and a skin, but a skeleton of steel that is strengthened with a muscular wrapping of wire and concrete. Some muscle between skin and bone.

It seems to me that the builders of the past, and also the ferro-concrete builders, produced fleshy and invertebrate buildings, whereas the steel-frame constructors produce buildings which might in biological terms be described as crustaceous or as a "bag of bones." We have yet to develop a form of construction which is a combination of these two methods, which permits of much less steel than is used in



the latter method, and much less wire and concrete than is used in the former.

I put it to our engineers to consider the possibilities of such a more subtle form of construction. I think that the reason why I am not able to cite an example, and not even one that was obviously an experiment, is because in actual practice building construction divides itself so antagonistically between those who favour reinforced concrete and those who favour the steel frame. Incidentally, it may be mentioned that the latter is rapidly giving way to the former.

Apart from the question of cost there are numerous appendages, if you like to call them so, ornaments or trinkets which can be made use of by the modern architect, and which though not part of the construction, nor necessarily direct expressions of actual construction, may be utilized as polite architectural assets, suggesting perhaps a superlative use. I refer to such features as the cornice, the architrave, and the column, the cartouche, the crochet or the finial. Using these in modern architecture, we are not tied down to those proportions which tradition associates with the more elemental methods of building employed in the past. We are not bound to accept the proportions given to us by Ictinus for the Column, nor the proportions of the Roman Orders, nor the recognized possibilities of Gothic arches. When Ictinus finished the Parthenon, he freed himself from the trammels of traditional proportion, and in his little temple dedicated to Apollo Epicurus, Bassai, he inverted the caps, and out of pure desperado played havoc with tradition.

The Swedish architects, and the best of the modern architects in Germany and France, freed from the restriction placed upon them by the use of elemental materials, now use columns and pilasters of almost any proportion, with or without cap or base.

Mentioning the Column induces me to challenge the ultra-modern architect with being somewhat foolishly nervous of its use. The ultra-modern architect appears so fearful of giving expression to some feature which either he cannot justify on the grounds that it is not directly functional, or



because it may happen to be one of the symbolic attributes of tradition, that he rushes to the opposite extreme, and produces a building which is as uninteresting as it is bald.

To re-create traditional architecture so as to give expression to the basic sensations of the human race and with modern materials and construction, is an extremely difficult undertaking. The re-creation of new forms of ornament is full of danger and immersed in pitfalls. We have, all of us, seen the effect of trying new kinds of flutings and ornaments, which without emphasizing a fine system of construction, or without symbolizing some human tradition, do nothing more than emphasize the ignorance and crude mentality of the exponent. But I think I have dwelt at sufficient length on the big question of how to use modern materials so as to produce a form of architecture which, whilst being sympathetic towards the embodiment of architectural tradition, might, if well disposed, produce something even bigger and nobler than anything that has yet been seen.

From treatments of main masses let me say a word about finishings, skins and coverings.

It is in the possibilities of clothing that modern architecture is presented with vistas of endless invention. Not fifty years ago, apart from the use of such exotic, or semi-exotic, materials as marble and mosaic, buildings, if not brought to a fine finish in brick or stone, could only be faced with plaster or paint; and this applied both to materials used internally as well as externally.

The materials that can be used to-day as "skins" to be applied to a matrix of concrete or rough brickwork are very numerous. First of all, one might mention granite and marble, impossible in the past except in the most extravagant and luxurious buildings.

As an example I might mention Mr. Hood's radiator building in Marlborough Street, which affords a very satisfactory example of the modern use of black granite: or I might mention Mr. Welch's building in Holborn for Messrs. Drage. The greater use of marble for shop fronts is also a conspicuous example of a new use for an old material, and also the greater use of marble as an interior lining. We



have only to quote Lyons' Corner House at the corner of Tottenham Court Road.

There are now very many excellent methods of producing artificial marbles, some of which are so good as imitations that they satisfy all the requirements that are expected of real marble.

I am not here to advocate the use of imitation or artificial materials, nor of entirely new materials which may be regarded as taking the place of the elemental building materials of the past, and I may be making a somewhat contentious statement when I say that it is a perfectly honest procedure, and a very sensible one, to use imitative and artificial materials, provided they satisfy all the requirements of the natural material, and that we are quite open in our dealings and perfectly frank in our constructional deceit. Provided we know that "graining" is graining, "marbling" is not marble, and artificial jointing, as used in Stucco, not real jointing, I see no objection to a little perfectly frank and amusing deceit. It only shows what the artist could do if he had the cash. If we don't get the thing itself we at any rate get all that the brains of the artist can contribute—"the idea."

I have mentioned marble as a skin: this is not quite the use that was made of it in Giotte's Campanile in Florence—that is essentially a marble building with a brick core. The modern use of marble is to have a solid concrete building with a marble skin.

Referring to "skins," let it at once be pointed out that these in modern practice may be divided into plasters, woods and marbles. The plasters that are used to-day may be classified into three varieties—the lime plasters, the quick-setting plasters of Paris, hard wall plasters which may be said to include Siripite, Victorite and Statite, and Keene's cement. Strictly speaking, none of these can receive paint directly they are put on. Unless applied to a damp surface they will peel off. If the wall is dry, the surface must be damped, and it will dry and set very quickly, and can be painted without much delay. It is said that you can paint directly on to Keene's cement,



and so you can, immediately it is finished from the trowel, but only one coat, and a finishing coat must be applied much later.

Then we come to that excellent material—Terrazzo. The use of Terrazzo has long since passed its experimental stage. Provided we have an even temperature and solid walls there need be no fear of cracking : or it may be used as a form of marble slab. It can be cast into slabs and used in large pieces as divisions. A tendency to cracking when used in floors can be overcome by the use of divisional metal strips.

The number of materials that can take the place of marble is very numerous. Probably as a direct imitation the best is "Produit lap." It is a French product and has a chemically treated luminous cement base. Then we have innumerable other materials, such as enamel slate, a material composed of plaster of Paris cast on to glass and varnished ; and asbestos with enamel surfaces. Also numerous varieties of clouded glass which we call "Vitrolite."

All these materials provide us with new opportunities for lining the walls of bathrooms, halls, and apartments where wet and damp is liable to destroy the softer surfaces.

And then we come to those wonderful new materials plywood, plymax, and laminated boards. These give us every kind of wood surface and can be used as wall coverings, floor coverings and in the manufacture of doors and fittings of all kinds. Indeed, the introduction of these new materials has completely revolutionized interior decoration and joinery.

Used in large surfaces the difficulty is the jointing. In the best work this is wonderfully overcome by stripping the top layer of wood on either side of the joint and inlaying.

Quite recently pressure applied to plywood has given us all kinds of surfaces that are ribbed, cubed and corrugated, in any kind of wood.

And then we come to another class of material which forty years ago was represented by fibrous plaster. Fibrous plaster was followed by Essex Board—a soft pulpy form of



cardboard. There are many improvements on these two old-fashioned materials. There is first of all the thistle board, which requires one coat of finished plaster ; and there is another kind of board—a  $\frac{1}{2}$ -inch insulating board—a hard board constructed with a plaster base which only requires facing up between the joints before painting or distempering. And there is Cellutex, an insulating board that is warm and takes paint, but the joints must be covered with wood strips. And there is another type of utility board which is made under very great pressure—it is only about  $\frac{1}{8}$  inch thick, can be nailed on to battens, and only requires the joints filling, before being painted.

As a finished skin to apply to a plaster wall and as something better than Lincrusta, we have Rexine—a sort of artificial leather which is glued to the plaster wall and can be produced in any colour. Another similar material is Lancaster Cloth. Also we have Japanese papers made of the thinnest layers of real wood.

Then we come to a whole class of materials of which Cellulose is the base. All have an ivory surface and when used definitely to take the place of ivory are a very good substitute. They are known as Bakelite. Such an ivory surface can be applied to plywood.

Another entirely new material which has only really come upon the market during the last four or five years is stainless steel commonly called "Staybrite," or its companion chromium plating. With this new metal surfacing, which is absolutely rustless, we are enabled to produce all kinds of metal effects and metal finishings, such as were previously quite unknown.

I might continue by enumerating the many uses that are now made of vulcanite. I have recently seen a form of vulcanite rubber used for stair-treads, which is a little warmer and softer than carborundum in cement, and I might enlarge upon the many uses of cork. I remember the time, forty years ago, when engaged as an architect's assistant, I had charge of the construction of a private swimming bath. A firm came along and laid down solid cork slabs in mastic along the fairway. These caused endless



trouble—they used to curl and rise and finally had to be tacked down with needles. To-day cork is crumbled and made up into slabs, and so cleverly is it manipulated that a cork floor can be produced with the accuracy of a floor of tiles, and when polished with wax it is capable of everlasting wear.

In this somewhat superficial reference to the more outstanding of our modern materials, I must conclude by referring to the modern uses of glass. Not only has glass, as glass, been made the subject of innumerable experiments by such treatments as sand-blasting, grinding and chemically treating, but a whole series of wall surfacings whose basis is glass, and which have been used very largely in connection with the fitting-up of bathrooms, have appeared.

But perhaps no new feature has so revolutionized our elevations as the steel window. Windows are the eyes of a building, and whether you look through them, or at them, they are the most important feature in the façade. The success of the steel-framed window has been astonishing. To-day it is only on rare occasions that we use wood. With the steel window we use larger panes of glass, and this with the flat roof has led to the horizontal feeling, which was common when casement windows came to be carried down to the ground in the late Georgian and Early Victorian periods.

If there is one part of a building to which more attention is given to-day than another, it is to the floors. Floors have immensely improved. Frequently the boards are laid in narrow widths in oak, or one can have a counter floor and oak surfacing. Oak is now shipped from America and Japan in large quantities for floors. Except in the very poorest buildings floors to-day are of solid or  $\frac{1}{4}$ -inch surfacing oak.

But this introduction of new materials and methods of construction has not left the respectable practitioner of the end of last century quite as independent as he was.

Fifty years ago we wrote our own specifications, made all our drawings, and knew how to carry out every inch of the work. The use of a great variety of new materials



has made it necessary to call in a host of specialists, who take the particular piece of work they are to be engaged upon completely in hand.

In this way there is a tendency for architects to become "agents" for all kinds of specialists who, describing themselves as "engineers," creep in, and we feel that they have some miracle to perform which it is not for us to understand.

Indeed, not only in regard to the design of the steel frame, or the distribution of reinforced concrete, or to the system of heating and lighting, but also to assist us with furnishings and fittings of all kinds, the specialist must be called in. So it is coming to this : that an architect's function is to find the client, decide the main lines of the plan if his client does not do this for him, advise on the general type of construction, and then his work is done. This being so, no wonder the amateur, the builder and the engineer are themselves as well placed to carry out architecture as the qualified architect.

I put it to you who are architects that you must master your construction, and must regard it as important to be able to design a steel building and to introduce any new methods of heating as does the engineer. I mention all this because I feel that the effect of using so many new materials which bring with them so many new ways of building, is really having a most disintegrating effect on the organization of the profession. I merely mention it, that we may not be suddenly surprised to find that our work is being taken away from us.

It may be a good thing to have all these specialists, and it may be necessary, but if a change is to take place in the organization of building, let us recognize it and guide it, and don't let us be taken by surprise.



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